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A new species and a new record of *Pero* Herrich-Schäffer, 1855 (Lepidoptera, Geometridae) in the Andes of southern Peru

Carlos Palacios[1], Jackie Farfán[1,2], José Cerdeña[1,2], Ana Lazo-Rivera[1], Luis E. Parra[3], Héctor A. Vargas[4]

1 *Universidad Nacional de San Agustín de Arequipa, Escuela Profesional de Biologia, Av. Alcides Carrión s/n, Arequipa, Perú; cpalaciosc@unsa.edu.pe; jjackie4u@gmail.com; cerdenajoseal@yahoo.es; alazor@unsa.edu.pe*

2 *PPG Biologia Animal, Departamento de Zoologia, Instituto de Biociências, Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves, 9500, Porto Alegre, RS 91501-970, Brazil*

3 *Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Casilla 160-C, Concepción, Chile; luparra@udec.cl*

4 *Departamento de Recursos Ambientales, Facultad de Ciencias Agronómicas, Universidad de Tarapacá, Casilla 6-D, Arica, Chile; lepvargas@gmail.com*

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Abstract. Two species of the moth genus *Pero* Herrich-Schäffer, 1855 (Lepidoptera, Geometridae, Ennominae, Odontoperini) are added to the fauna of the Andes of southern Peru in the Arequipa Department. *Pero lopezi* Vargas & Palacios **sp. nov.** is described and illustrated based on male adults collected in Pocsi, at 2900 m elevation. *Pero atridisca* Dognin, 1906, previously known from Angasmarca (La Libertad), is recorded for the first time in Arequipa, significantly expanding its distribution range.

Introduction

The genus *Pero* Herrich-Schäffer, 1855 (Lepidoptera, Geometridae, Ennominae, Odontoperini) is represented by 313 described species, 294 in the Neotropics and 19 in the Nearctic region (Poole 1987; Herbulot 2002; Pitkin 2002; Ferris 2003; Lévêque 2006, 2007, 2010; Brown 2007; Vargas 2007). The list includes the two species previously ascribed to the Neotropical *Nepitia* Walker, 1866, a genus recently synonymized with *Pero* based on a molecular phylogenetic study that also provided support for the synonymy of Azelinini with Odontoperini (Brehm et al. 2019). South American species of *Pero* are mostly associated with Andean habitats, from mid-elevation eastern wet forest to xerophytic scrubland of western slopes, and with southeastern Brazilian habitats (Poole 1987; Lévêque 2007; Vargas 2007; Cerdeña et al. 2019). Faunistic studies have revealed high diversity of *Pero* in moist forest of the Andes (Brehm et al. 2016). Almost all of the currently recognized species of *Pero* distributed in Peru come from the northern and central Andes (Poole 1987; Herbulot 2002; Lévêque 2007, 2010).

The genus *Pero* is well diversified in the Andes but only one species has been recently reported from Andean environments of southwestern Peru (Cerdeña et al. 2019). However, a few discoveries dealing with this genus and other representatives of Geometridae in similar arid environments suggest that this poor representation is due more to a lack of data from low collection effort than to low diversity in this geographic area (Vargas and Hausmann 2008; Vargas et al. 2020).

The aims of this study are to further update the records of *Pero* species recently collected in the Department of Arequipa and to describe formally a new species of *Pero*, based on male specimens collected in the locality of Pocsi, at 2900 m elevation.

Material and methods

The specimens examined in this study were collected in different sites between about 2200 and 4100 m elevation in the Andes of the Arequipa Department, southern Peru, between September, 2017 and September, 2019, using two light traps, one with 250 watt mercury vapor mixed light and other with one LepiLed UV lamp (Brehm 2017). The collected specimens were mounted following standard procedures. Male genitalia were removed from abdomens and soaked in 10% KOH solution for ten minutes. Subsequently, abdomens were preliminarily cleaned of soft tissue in water in order to expose the genital parts, then stained in Eosin Y to identify genital parts. Dissected genitalia were cleaned of water using ethanol 90% and 95% solutions, and mounted in Euparal. Genitalic terminology follows Poole (1987). Length measurements are in metric units and were made from photographs of specimens taken next to a scale and magnified on a computer screen. Photographs of adults were taken with a Nikon D610 digital camera through a Nikkor 105 mm f/2.8G AF-S VR Micro lens; photographs of genitalia structures were taken with SMZ25 Nikon stereomicroscope. Images were assembled and edited in Photoshop CS5.1.

Abbreviations of institutional collections

MUSA Museo de Historia Natural, Universidad Nacional de San Agustín de Arequipa, Peru.

Results

Pero lopezi Vargas & Palacios, sp. nov.

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Figs 1, 2

Type material. ***Holotype***, male: PERU. Peru, AR[equipa], Pocsi, Carretera Mollebaya-Pocsi, 16°30'56"S, 71°25'52"W, 2900 m, 17–24.iii.2018, Leg. S. Ramos, M. Condori, M. Arivilca, L. Olivera (MUSA). BOLD specimen page BC ZSM Lep add 300.

Paratypes, PERU, eight males. One male, same data as holotype, genitalia slide GeoAr01 (MUSA); six males, same data as holotype, but 03.ii.2018, genitalia slide GeoAR13 (MUSA); one male Peru, AR[equipa], Chiguata, Bosque *Polylepis* sp., 16°23'33"S, 71°19'07"W, 4090 m, 17–23.iii.2018, Leg. L. Pinto, G. Aliaga, Y. Aguilar, G. Rodriguez, genitalia slide GeoAr11 (MUSA).

Type locality. Peru, Arequipa Department, Pocsi, 16°30'S, 71°25'W, 2900 m.

Diagnosis. *Pero lopezi* is recognized by the slightly dentate postmedial line with outwardly rounded teeth on upperside of forewing (Fig. 1A), parallel-sided uncus with round apex and narrow longitudinal subscaphium (Fig. 2A) and phallus with a serrated carina near apex (Fig. 2C). The morphology of the male genitalia of *P. lopezi* allows it to be assigned to Group 15 sensu Poole (1987), among which this is remarkably similar to that of *Pero acopa* Poole, 1987. However, *P. lopezi* is easily separable from the species in this group, including *P. acopa*, due to the slightly dentate postmedial line with outwardly rounded teeth on upperside of forewing, narrow longitudi-

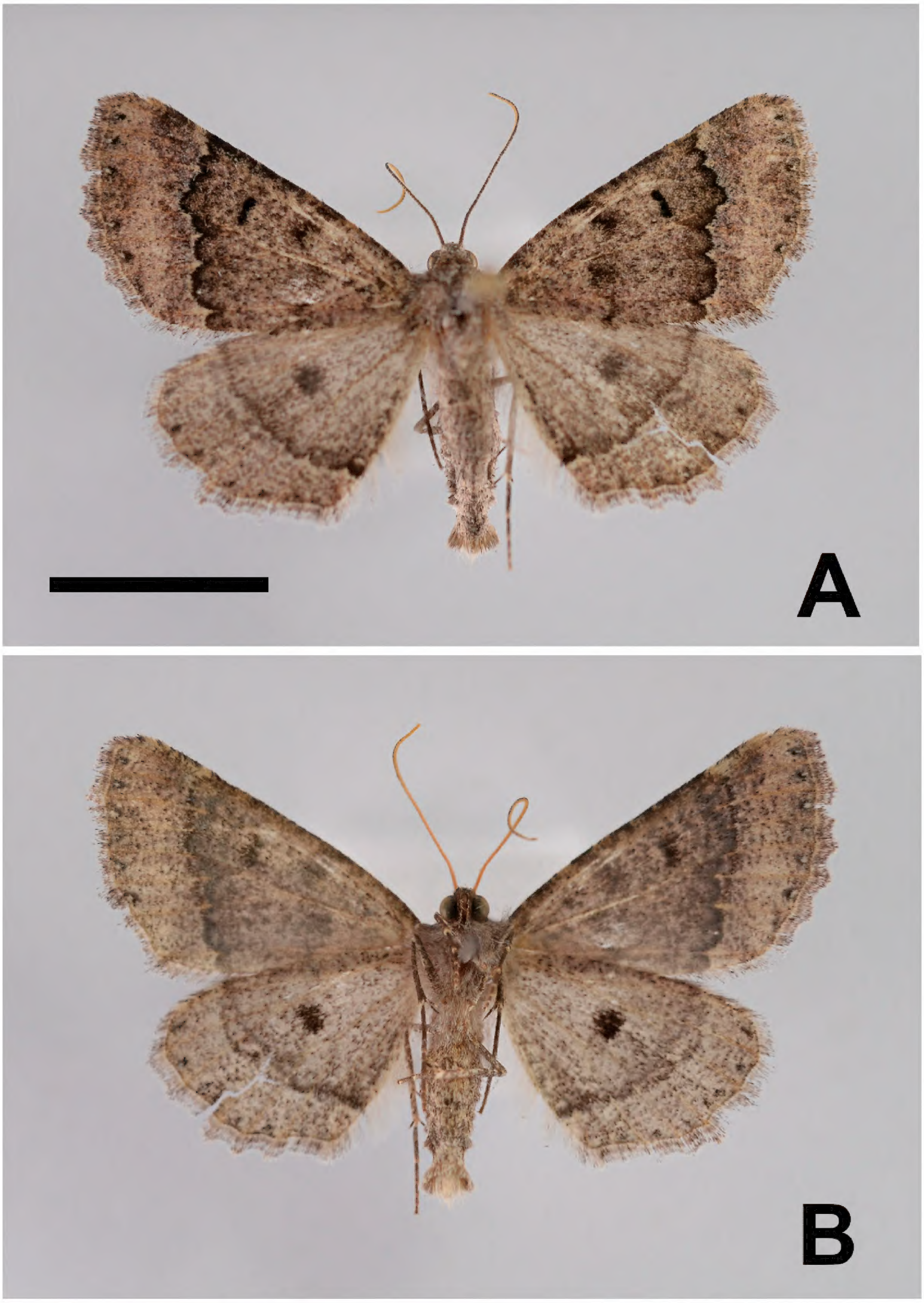

Figure 1. Adult stage of *Pero lopezi* Vargas & Palacios, sp. nov. **A.** Holotype male in dorsal view; **B.** Holotype male in ventral view. Scale bar: 1 cm.

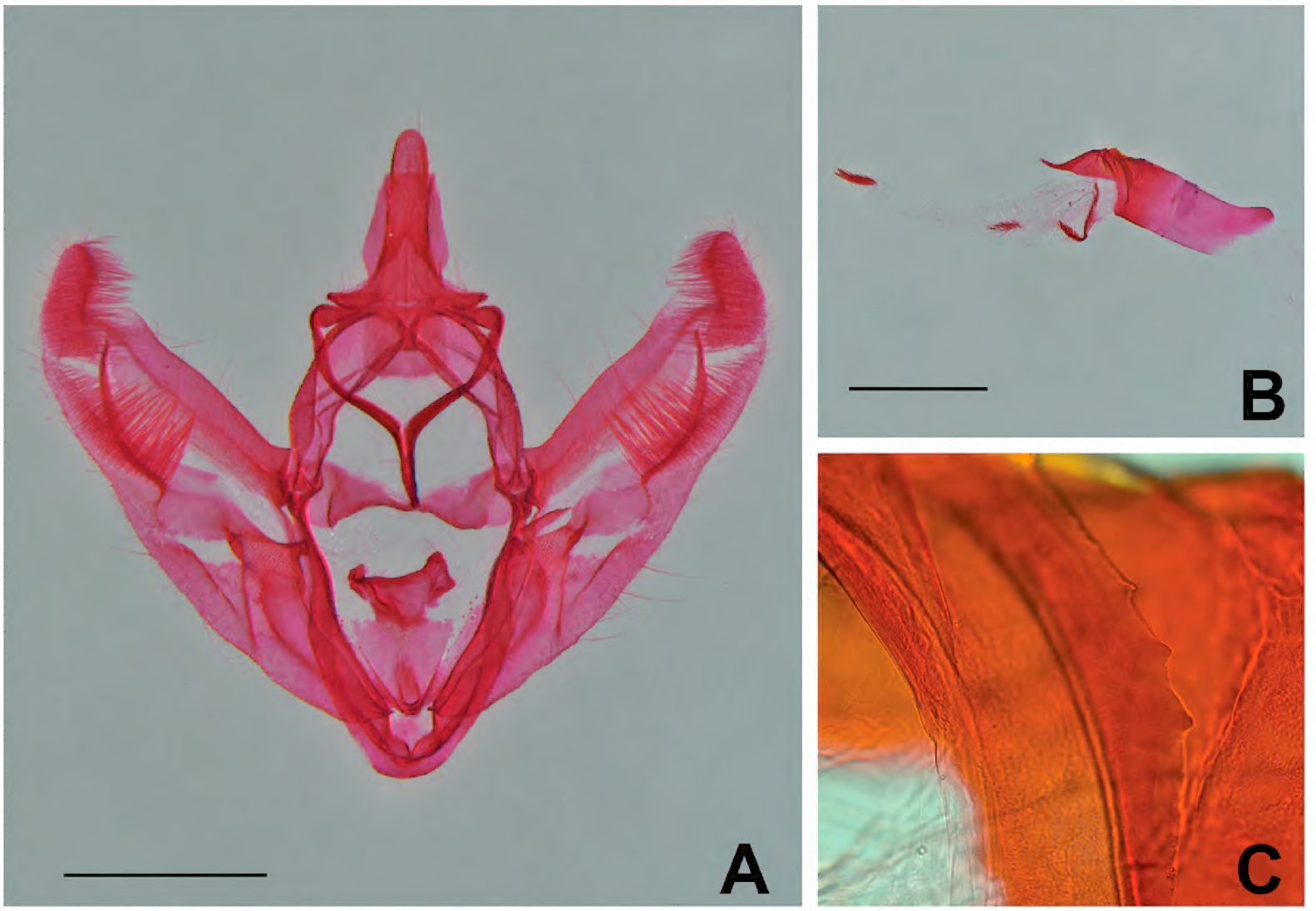

Figure 2. Male genitalia of *Pero lopezi* Vargas & Palacios, sp. nov. **A.** Male genitalia in ventral view, phallus removed; **B.** Phallus in lateral view; **C.** Detail of serrated carina of phallus close to apex. Scale bar: 1 mm.

nal subscaphium and phallus with a serrated carina near the apex. Moreover, the antennae of the male in *P. acopa* are pectinate, but not in *P. lopezi*.

Male. (Fig. 1) Forewing length 17–18 mm (n = 9)

Head. Mostly greyish brown, some scales slightly darker or lighter subapically. Vertex with narrow, slightly elongated scales. Frons appressedly scaled. Antenna filiform, about 2/3 forewing length, dorsally with whitish brown scales, ventrally shortly ciliated. Labial palp greyish brown; first segment with narrow, elongated scales anteroventrally projected partially concealing the base of second segment; second segment with shorter scales; third segment appressedly scaled.

Thorax. Mostly with narrow, elongated greyish brown scales dorsally, mostly with long, hair-like whitish greyish brown scales laterally. Legs mostly greyish brown with a few lighter and darker scales scattered. Forewing mostly greyish brown with dark brown scales scattered; antemedial line dark brown, mostly sinuate, sharply angled outward near costal margin; discal dot blackish brown, as a short transverse stripe near distal margin of cell; postmedial line broad, dark brown outwardly, lighter inwardly, slightly dentate with outwardly rounded teeth, a larger tooth near posterior margin; five small circular creamy white spots forming a line close to distal margin, each spot with a narrow dark brown stripe proximally. Hindwing mostly whitish brown basally, greyish brown distally, darker scales scattered; discal dot dark brown, circular; postmedial line slightly dentate, dark brown, lighter near anterior margin.

Abdomen. Greyish brown with lighter and darker scales scattered. Segment VIII slightly sclerotized, anterior margin broadly concave, lateral margin broadly convex, distal margin rounded.

Male genitalia (Fig. 2). Tegumen narrow, anterior margin sharply cleft, posterior margin concave. Saccus narrow, U-shaped. Socius membranous with a few hair-like setae. Uncus mainly parallel-sided, lightly wider basally, apex rounded. Subscaphium as a narrow, longitudinal rectangular sclerite. Gnathos Y-shaped; ventral arm about 2/3 the length of lateral arm, slightly curved posteriorly. Juxta in two parts, triangular basally, semicircular dorsally, lateral incision near middle, dorsal part slightly asymmetric, left apex narrower than right apex, dorsal margin slightly concave. Transtilla narrow near middle. Valvae symmetrical, somewhat rectangular, slightly wider basally, dorsal margin about a half of ventral margin; costa well-sclerotized until about 3/4 length of dorsal margin, about a third the height of valva, distal part suddenly narrowed; distal part of valva mainly membranous, costal fold with abundant hair-like setae; median process well-developed, sculptured; distal half of sacculus as a narrow, longitudinal lobe with hair-like setae; a diagonal, slightly curved furrow from near middle of sacculus to near apex of costa. Phallus sub-cylindrical (Fig. 2B), similar in length to dorsal margin of valva, distal third suddenly excavated dorsally, a well-developed serrated carina ventrally near apex (Fig. 2C); vesica with a narrow, slightly sinuous cornutus basally and two groups of spine-like cornuti, one at middle, another at apex.

Female. Unknown.

Geographic distribution. (Fig. 4). *Pero lopezi* is only known from the type locality, Pocsi, in Arequipa Department, and surroundings, between 2900 and 4090 m elevation.

Etymology. This new species is dedicated to Dr. Evaristo Luciano Lopez Tejeda, Director of Museo de Historia Natural Universidad Nacional de San Agutin de Arequipa (MUSA), in recognition of his invaluable work on the fauna of the Department of Arequipa and southern Peru.

Host plant. Unknown.

Remarks. Although identification of species of the genus *Pero* is mainly based on morphology of the male genitalia (Poole 1987), it has been suggested that structures of the female genitalia also provide useful characters for identifications of the species of this genus, including those of Group 15 (Lévêque 2006, 2007; Dias 2008; Vargas 2019). Females of *P. lopezi* were searched for, without success, in the type locality after we recognized the males as representatives of an undescribed species. Accordingly, further sampling will be needed to know this species better.

Pero atridisca Dognin, 1906

Fig. 3A, B

Material examined. Peru. Two males: Peru, AR[equipa], Valle Colca, Vía Cabanaconde – Yaguar, 15°35'22"S, 72°00'06"W, 2200 m, 05.ix.2019, Leg. M. Condori, M. Arivilca, C. Palacios (MUSA).

Remarks. *Pero atridisca* was described from Angasmarca, La Libertad Department, Peru. The discovery of this species in Arequipa expands its range south in the Andes more than 1000 km (Fig. 4). Adult and male genitalia were illustrated by Poole (1987). The species identity awaits further study and confirmation by molecular data (DNA barcoding).

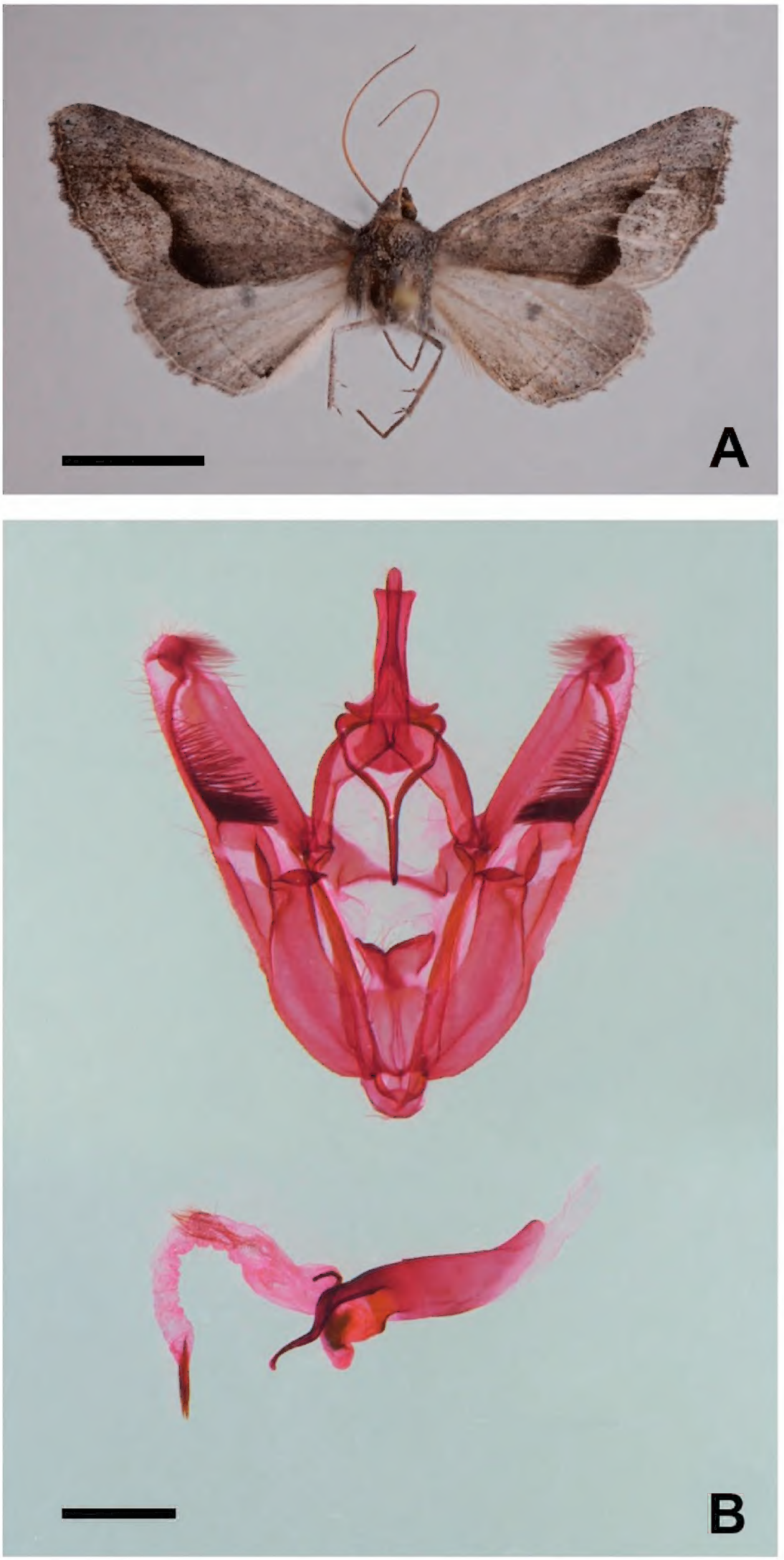

Figure 3. Adults (dorsal view) and male genitalia. **A, B.** *Pero atridisca* Dognin, 1906. Scale bar: 1 cm (**A.**); 1 mm (**B.**).

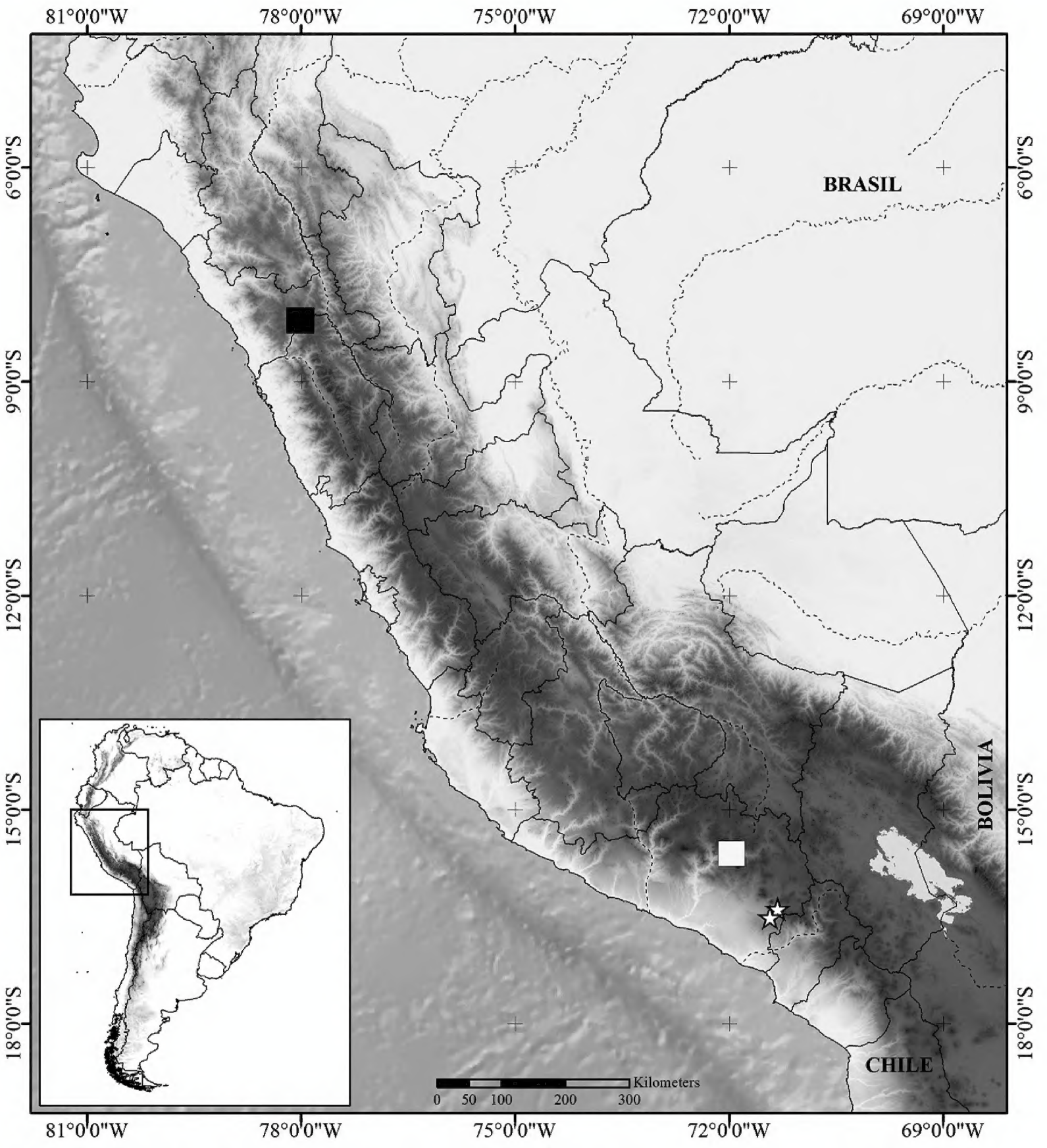

Figure 4. Geographic distribution of *Pero lopezi* Vargas & Palacios, sp. nov. (white stars) and *Pero atridisca* Dognin, 1906 (squares) in Peru. Symbols: black square (locality type), white square (new record).

Discussion

The discovery of these two species of *Pero* confirm the importance of the arid environments of the Andes for the representatives of Group 15 of this genus, already highlighted by Poole (1987). The number of species of *Pero* of the Arequipa Department increases to three, as only one was recorded previously (Cerdeña et al. 2019). It is expect that additional species will be discovered with further sampling. As the Neotropical species of *Pero* appear to be highly specialized in host plant use

(Poole 1987; Vargas 2011), future surveys should be undertaken using light traps in underexplored habitats harboring different native plants to enhance the probability to collect more species of the genus with a better representation of the native flora in different sampling sites.

Despite the importance of the knowledge of immature stages and natural history to the understanding of ecology and systematics of Lepidoptera, these aspects remain poorly studied for the Neotropical representatives of *Pero* (Vargas et al. 2017). In order to gain insights in this regard, surveys for immature stages on native plants should be implemented, as detailed knowledge of geographic distribution and host plant use of these moths and other Lepidoptera (Farfán et al. 2020a, b) could be a useful tool to plan further studies dealing with conservation biology in the amazing arid environments of the Andes of southern Peru.

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